00274

ENGINEERING CHANGE NOTICE

Page 1 of 2

1. ECN 186789

Proj. ECN

2. ECN Category (mark one) Supplemental [] Direct Revision [x] Change ECN [] Temporary [] Standby [] Supersedure [] Cancel/Void []	3. Originator's Name, Organization, MSIN, and Telephone No. R. R. Lehrschall, Environmental Restoration Safety Support, N1-75, 376-6788 W29550		4. Date 1-12-93
	5. Project Title/No./Work Order No. HIBBE/Vapor Extraction Characterization Unit	6. Bldg./Sys./Fac. No. 216-Z Crib Sites	7. Impact Level 2 ESQ
	8. Document Numbers Changed by this ECN (includes sheet no. and rev.) WHC-SD-EN-SAD-004, Rev 0-A	9. Related ECN No(s). 169357	10. Related PO No. N/A

11a. Modification Work	11b. Work Package No.	11c. Modification Work Complete	11d. Restored to Original Condition (Temp. or Standby ECN only)
[] Yes (fill out Blk. 11b) [X] No (NA Blks. 11b, 11c, 11d)	N/A	N/A Cog. Engineer Signature & Date	N/A Cog. Engineer Signature & Date

12. Description of Change

The changes to this document are for allowing operation of a vapor extraction system unit for characterization of carbon tetrachloride (CCl_4) vapors. The unit will sample CCl_4 vapors as they are removed from the vadose zone soils. This will be required to determine the locations where the highest concentrations of CCl_4 are located.

Additional consequence analysis has found that operation of the characterization unit would not result in exposures that would exceed the limits for a low hazard activity or the consequences identified in the worst case bounding accident previously evaluated in the baseline CCl_4 safety assessment document.

13a. Justification (mark one)			
	Criteria Change [x]	Design Improvement []	Environmental []
As-Found []	Facilitate Const. []	Const. Error/Omission []	Design Error/Omission []

13b. Justification Details

The changes to the baseline document are for providing justification and documenting results of additional consequence analysis. The analysis found that the design and operation of the characterization unit would not result in unacceptable consequences to the receptors of concern or the environment.

14. Distribution (include name, MSIN, and no. of copies)

T. L. Bennington	H4-16	V. J. Rohay	H6-06
L. P. Diediker	T1-30	M. A. Tredway	R3-54
M. C. Hagood	H4-55	D. B. Tullis	L6-57
N. R. Kerr	N1-75	J. J. Zimmer	N1-83
R. R. Lehrschall	N1-75	Central Files	L8-04

RELEASE STAMP

OFFICIAL RELEASE BY WHC 20
DATE JAN 28 1993
Sta. 21

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ENGINEERING CHANGE NOTICE

1. ECN (use no. from pg. 1) 186789

15. Design Verification Required	16. Cost Impact				17. Schedule Impact (days)	
	ENGINEERING		CONSTRUCTION			
[] Yes	Additional	[] N/A	Additional	[] N/A	Improvement	[] N/A
[X] No	Savings	[] N/A	Savings	[] N/A	Delay	[] N/A

18. Change Impact Review: Indicate the related documents (other than the engineering documents identified on Side 1) that will be affected by the change described in Block 12. Enter the affected document number in Block 19.

SDD/DD	[]	Seismic/Stress Analysis	[]	Tank Calibration Manual	[]
Functional Design Criteria	[]	Stress/Design Report	[]	Health Physics Procedure	[]
Operating Specification	[]	Interface Control Drawing	[]	Spares Multiple Unit Listing	[]
Criticality Specification	[]	Calibration Procedure	[]	Test Procedures/Specification	[]
Conceptual Design Report	[]	Installation Procedure	[]	Component Index	[]
Equipment Spec.	[]	Maintenance Procedure	[]	ASME Coded Item	[]
Const. Spec.	[]	Engineering Procedure	[]	Human Factor Consideration	[]
Procurement Spec.	[]	Operating Instruction	[]	Computer Software	[]
Vendor Information	[]	Operating Procedure	[]	Electric Circuit Schedule	[]
OM Manual	[]	Operational Safety Requirement	[]	ICRS Procedure	[]
FSAR/SAR	[]	IEFD Drawing	[]	Process Control Manual/Plan	[]
Safety Equipment List	[]	Cell Arrangement Drawing	[]	Process Flow Chart	[]
Radiation Work Permit	[X]	Essential Material Specification	[]	Purchase Requisition	[]
Environmental Impact Statement	[]	Fac. Proc. Samp. Schedule	[]	Hazardous Waste Operations Permit	[X]
Environmental Report	[]	Inspection Plan	[]		[]
Environmental Permit	[]	Inventory Adjustment Request	[]		[]

19. Other Affected Documents: (NOTE: Documents listed below will not be revised by this ECN.) Signatures below indicate that the signing organization has been notified of other affected documents listed below.

Document Number/Revision	Document Number/Revision	Document Number Revision
NA		

20. Approvals

Signature	Date	Signature	Date
OPERATIONS AND ENGINEERING		ARCHITECT-ENGINEER	
Cog Engineer V. J. Rohay *VJ Rohay*	1/15/93	PE	
Cog. Mgr. M. C. Hagood *MC Hagood*	1/15/93	QA	
QA T. L. Bennington *[signature] for*	1/20/93	Safety	
Safety M. A. Tredway *[signature]*	1/19/93	Design	
Security		Environ.	
Environ. L. P. Diediker *LP Diediker*	1-19-93	Other	
Projects/Programs			
Tank Waste Remediation System			
Facilities Operations		DEPARTMENT OF ENERGY	
Restoration & Remediation		Signature or Letter No.	
Operations & Support Services			
IRM		ADDITIONAL	
Other ERSS N. R. Kerr *BB. Lehnhard for*	1-18-93		
RRSA J. J. Zimmer *[signature]*	1/17/93		

9 3 1 2 9 3 1 5 2 4

SUPPORTING DOCUMENT

1. Total Pages ~~264~~ 261

2. Title	3. Number	4. Rev No.
Safety Assessment for the 200 West Area Expedited Response Action for Remediation of Carbon Tetrachloride	WHC-SD-EN-SAD-004	0-B

5. Key Words	6. Author
Granular Activated Carbon Safety Assessment Gas Membrane Separation System Low Hazard	Name: R. R. Lehrschall R R Lehrschall 1-2-93 Signature Organization/Charge Code 29550/HIBBE

APPROVED FOR PUBLIC RELEASE. 1/25/93 D Sollie

7. Abstract

The changes to this document are for providing justification and documenting the results of additional consequence analysis.

8. PURPOSE AND USE OF DOCUMENT - This document was prepared for use within the U.S. Department of Energy and its contractors. It is to be used only to perform, direct, or integrate work under U.S. Department of Energy contracts. This document is not approved for public release until reviewed.

PATENT STATUS - This document copy, since it is transmitted in advance of patent clearance, is made available in confidence solely for use in performance of work under contracts with the U.S. Department of Energy. This document is not to be published nor its contents otherwise disseminated or used for purposes other than specified above before patent approval for such release or use has been secured, upon request, from the Patent Counsel, U.S. Department of Energy Field Office, Richland, WA.

9. Impact Level 2 ESQ

10. RELEASE STAMP

OFFICIAL RELEASE BY WHC (20) DATE JAN 28 1993 Sta. 21

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RECORD OF REVISION

(1) Document Number: WHC-SD-EN-SAD-004

Page #7

(2) Title

Safety Assessment for the 200 West Area Expedited Response Action for Remediation of Carbon Tetrachloride

CHANGE CONTROL RECORD

(3) Revision	(4) Description of Change - Replace, Add, and Delete Pages	Authorized for Release (5) Cog. Engr.	Authorized for Release (6) Cog. Mgr. Date
	Rev. 0 released per EDT 129408. d+d. 2/4/92 Rev. 0-A released per ECN 169357, d+d. 11/20/92 Rev. 0-B released per ECN 786789, d+d. 1/28/93	VSKaley 1/15/93	mcAyan 1/15/93
0-B RS	Replace pages 41 and 42; Prudent Actions 2, 4, and 12; Recommendation has been added to survey unit for radioactive contamination and use of a record sampler for detection of any airborne radioactivity. Reference has been revised. Maintain a 50 ft exclusion zone around the VES operations.		
0-B	Replace pages 43 and 44, Section 5.0; reference list has been revised entirely.		
0-B	Attachment G: Additional consequences analysis attached.		

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A-7320-005 (08/91) WEF168

RECORD OF REVISION	(1) Document Number WHC-SD-EN-SAD-004	Page 6

(2) Title
Safety Assessment for the 200 West Area Expedited Response Action for Remediation of Carbon Tetrachloride

CHANGE CONTROL RECORD

(3) Revision	(4) Description of Change - Replace, Add, and Delete Pages	Authorized for Release (5) Cog. Engr.	(6) Cog. Mgr. Date
	Rev. 0 released per EDT 129408, d+d. 2/4/92 Rev. 0-A released per ECN 169357, d+d. 11/24/92 Rev. 0-B released per ECN 786789, d+d. 1/28/93	V J Riley 1/15/93	M C Hagood 1/15/93
0-B RS	Replace page 34; reference has been revised in third paragraph and fourth paragraph has been added. Discussion of the Plutonium Finishing Plant (PFP) emergency response actions for those individuals who work inside the safety envelop for PFP.		
0-B	Replace page 35, Table 6 , "Assessments of Hazards and Controls," items one and two under mitigation. Discussion of personnel training for operation of characterization unit. Monitoring requirements during operation of the characterization unit.		
0-B	Replace page 36; page number has been revised.		
0-B	Replace page 37; Section 4.1.6.1; number of saturated canisters shall be reduced to 12 as soon as reasonably possible.		
0-B	Replace page 38, Section 4.1.8, and Section 4.2.4a and 4.2.4b. Incorporation of characterization unit. Training requirements for operating and shutting down system.		
0-B	Replace pages 39 and 40, Sections 4.2.5a and 4.2.6.1, item 2. Incorporation of characterization unit. Verification of personnel training. Personnel trained to shutdown operations.		

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(2) Title
Safety Assessment for the 200 West Area Expedited Response Action for Remediation of Carbon Tetrachloride

CHANGE CONTROL RECORD

(3) Revision	(4) Description of Change - Replace, Add, and Delete Pages	Authorized for Release (5) Cog. Engr.	(6) Cog. Mgr. Date
	Rev. 0 released per EDT 129408, d+d. 2/4/92 Rev. 0-A released per ECN 169357, d+d. 11/29/92 Rev. 0-B released per ECN 786789, d+d. 1/28/93	1/15/93	1/15/93
0-B RS	Replace page seven, item 14 and 16. Item 14 recommends an emergency response kit be available at the work site. Item 16 discusses emergency notifications responsibilities.		
0-B	Insert page 10.1.		
0-B	Replace page 16, Section 2.4, last paragraph, and Section 2.4.1, first paragraph. Discussion of using characterization unit for sampling CCl_4. Incorporation of characterization unit.		
0-B	Replace page 20, Section 2.4.2, first paragraph. Discussion of the smaller production unit.		
0-B	Replace pages 23 and 24, Section 2.4.4. Incorporation of new section discussing the design of the characterization unit.		
0-B	Replace pages 25 and 26; Figure 11 has been inserted.		
0-B	Replace page 27; reference has been revised.		
0-B	Replace pages 28, 29, and 30; new page numbers.		
0-B	Replace page 31; reference has been revised.		
0-B	Replace pages 32 and 33; references have been revised.		

RECORD OF REVISION	(1) Document Number WHC-SD-EN-SAD-004	Page 4

(2) Title
Safety Assessment for the 200 West Area Expedited Response Action for Remediation of Carbon Tetrachloride

CHANGE CONTROL RECORD

(3) Revision	(4) Description of Change - Replace, Add, and Delete Pages	Authorized for Release (5) Cog. Engr.	(6) Cog. Mgr. Date
	Rev. 0 released per EDT 129408, dtd. 2/4/92 Rev. 0-A released per ECN 169357, dtd. 11/24/92 Rev. 0-B released per ECN 786789, dtd. 1/28/93	VJGehal 1/15/93	mcHagood 1/15/93
0-B RS	Replace "Contents" section; page numbers revised.		
0-B	(7) Replace page four, Section 1.1, "Work Description," paragraphs one and three. Reference has been revised. Discussion of the maximum number of canisters that will be allowed. Changes to the scope of the assessment to include a characterization unit for sampling activities.		
0-B	Replace page five, Section 1.3, "Summary of Commitments," items 1 and 2. Discussion of production units being interlocked to shut down system. Summary of requirement for constant monitoring of the system during periods of operation.		
0-B	Replace page six, items 2 and 4. Recommendation to survey unit for radioactive contamination and use of a record sampler for detection of airborne radioactivity. Reference revised.		

RECORD OF REVISION	(1) Document Number WHC-SD-EN-SAD-004	Page 3

(2) Title

Safety Assessment for the 200 West Area Expedited Response Action for Remediation of Carbon Tetrachloride

CHANGE CONTROL RECORD

(3) Revision	(4) Description of Change - Replace, Add, and Delete Pages	Authorized for Release (5) Cog. Engr.	Authorized for Release (6) Cog. Mgr. Date
0-A	Replace page 35, Section 4.0, Item 4.1.4c, "Requirements"; changes are summarized below: Maximum number of fully saturated canisters allowed per interim storage at the work site.	[illegible] 11/18/92	[illegible] 11/18/92
0-A	Replace page 36, Item 4.1.8, "Basis" and item 4.2.4, "Requirements," (b); changes are summarized below: The accident analysis is based upon saturated canisters in interim storage and units being used in the process. Instrument reliability requirements for the flow rate meters and control logic. Requirements for operating in by-pass mode.		

Rev. 0 released per EDT 129408.
Rev. 0-A released per ECN 169357.

0-A Replace pages 37, 38, 39, 40, and 41; Prudent Actions have been numbered and numbers 15 and 16 have been added. Page 41 (Section 5.0) has been revised. H.M. 11/24/92

0-A RS Replace Attachment G.

RECORD OF REVISION	(1) Document Number WHC-SD-EN-SAD-004	Page 2

(2) Title
Safety Assessment for the 200 West Area Expedited Response Action for Remediation of Carbon Tetrachloride

CHANGE CONTROL RECORD

(3) Revision	(4) Description of Change - Replace, Add, and Delete Pages	Authorized for Release (5) Cog. Engr.	(6) Cog. Mgr. Date
0-A	Replace page 7 to incorporate new Prudent Actions (numbers 15 and 16): Emergency notification actions required in the event of off-normal conditions. Not more than one drum (partially or fully loaded with CCl_4) should be located at the work site. Emergency notification responsibilities and response actions should be addressed in the emergency plans for the CCl_4 work site and adjacent affected facilities.	11/18/92	11/18/92
0-A	Insert page 7.1.		
0-A	Replace page 23; addition of new Subsection 2.4.4, "Gas Membrane Separation System" is summarized below: Discussion of the GMSS and equipment required for the test.		
0-A	Replace pages 29 and 30; OSHA reference has been revised.		
0-A	Replace page 31; revisions made to the fourth paragraph and Table 4 values are summarized below: The bounding postulated scenario is due to rupturing three fully saturated canisters. Changes to the resultant exposures as identified in Table 4.		
0-A	Replace page 33, Table 6; changes were made to the second item under "Component Failures and Consequences" and additional discussion in the first item (second paragraph) under "Mitigation." Spill of carbon involving three fully saturated GAC canisters and 28 p/m. Discussion of instrument reliability and requirements for constant monitoring for CCl_4 vapors if operating in by-pass mode.		

Rev. 0 released per EDT 129408.
Rev. 0-A released per ECN 169357. H.M 11/24/92

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RECORD OF REVISION	(1) Document Number WHC-SD-EN-SAD-004	Page 1

(2) Title

Safety Assessment for the 200 West Area Expedited Response Action for Remediation of Carbon Tetrachloride

CHANGE CONTROL RECORD

(3) Revision	(4) Description of Change - Replace, Add, and Delete Pages	Authorized for Release (5) Cog. Engr.	Authorized for Release (6) Cog. Mgr. Date
0-A	(7) Replace "Contents" section; pages 1, 2, and 3; insert page 3.1. Changes reflect new page and sub-page numbers.	11/18/92	11/18/92
0-A	Replace page 4; changes are summarized below: Section 1.0: first sentence; change reflects new RL title. Section 1.1, "Work Description," paragraph 1, fourth sentence: Discussion of the maximum number of fully saturated canisters allowed in interim storage per storage location at the work site. Paragraph 3, first sentence: Discussion of Gas Membrane Separation System test.		
0-A	Replace page 5, Section 1.3, "Work Description," paragraph 1; revision is summarized below: Maximum number of fully saturated canisters allowed per interim storage location at the work site. Expanded discussion of requirements in item number 2; addition is summarized below: Discussion of instrument reliability requirements. Also additional options allowing operations in by-pass mode.		

Rev. 0 released per EDT 129408.
Rev. 0-A released per ECN 169357. H.M. 11/24/92

CONTENTS

ATTACHMENTS:

FIGURES:

TABLES:

1.0 INTRODUCTION AND SUMMARY

Westinghouse Hanford Company (Westinghouse Hanford) is preparing to perform remediation activities to mitigate the spread of carbon tetrachloride (CCl_4) within the Hanford Site 200 West Area unsaturated soils for the U.S. Department of Energy, Richland Field Office (RL). This activity is one of three Expedited Response Actions (ERA) that the U.S. Department of Energy (DOE), the U.S. Environmental Protection Agency (EPA), and the Washington State Department of Ecology agreed in late 1990 to undertake at Hanford. This safety assessment presents the results of the remediation activities associated with the CCl_4 ERA. The purpose of this assessment is to determine the potential consequences of an inventory of material associated with a facility or activity exclusive of engineered features or administrative controls (Kerr 1990).

1.1 WORK DESCRIPTION

The remediation activities will be conducted using a vapor extraction system (VES) for removal of CCl_4. Granular Activated Carbon (GAC) contained in Department of Transportation (DOT) approved canisters are used to adsorb the CCl_4 vapors. Fully saturated canisters will be stored for an interim period and then transported offsite for regeneration. A maximum of not more than twelve fully saturated canisters will be allowed in a storage location at the site. The VES process is used nationwide to remove a variety of volatile organic chemicals from vadose zone soils contaminated by leaks from underground storage tanks and other sources. The EPA has approved the use of vacuum extraction at more than 31 sites.

Task 7 of the Phase I site evaluation for the ERA compiled information on the volume and contaminant types found, contaminant concentration, and identification of the influence zone using the VES (Lehrschall 1990; DOE-RL 1991). Based on the test results, the VES successfully removes CCl_4 vapors from the vadose zone of the Hanford Site soils.

The scope of this assessment includes activities that will involve the use of several VES units to complete the ERA and conduct a treatability demonstration for performing a Gas Membrane Separation System (GMSS) test. The VES unit used during the Task 7 activities will be used for remediation until larger units are available. This assessment also addresses the hazards associated with the operation of the larger units (planned for the full scale remediation activities) based upon the current proposed design and a VES characterization unit used for sampling activities to determine the CCl_4 concentrations found at the boreholes throughout the well fields. Changes to the proposed designs will necessitate an evaluation of any new hazards and a possible addendum to this assessment. The design of the current system, larger production unit, and the characterization unit are discussed in Section 2.4.

The first phase of CCl_4 vapor removal will use existing vertical wells. The second phase will use existing vertical wells plus new vertical or horizontal wells. The installation (drilling) of any new wells is not evaluated and addressed in this safety assessment. The three major waste site locations are in close proximity to the Plutonium Finishing Plant (PFP).

These sites were the major contributors of CCl_4 to the soil and groundwater and will be the focal point for the remediation activities. The extracted vapors will be treated using carbon adsorption technology.

1.2 ASSESSMENT SUMMARY

This completed assessment found the design and plans to be safe. The report summarizes the findings and conclusions of the assessment for this ERA. The potential consequences of this remediation work indicate that the toxicity of CCl_4 is the controlling hazard for an accident involving airborne releases. The calculated results are conservative.

1.3 SUMMARY OF COMMITMENTS

The recommendations and controls identified are necessary to insure the bases of the boundary inventory release. The following are the required controls:

> The analysis disclosed this activity would be classified as a low hazard operation provided that fuel sources (other than the fork truck or similar equipment having small quantities of fuel) are maintained a minimum of 50 ft (15 m) away from the GAC canisters. The electric generator must also be maintained a minimum of 25 ft (8 m) away from the GAC canisters. A maximum of not more than twelve fully saturated canisters will be allowed per storage location at the work site.

The analysis indicates that the primary cause of a release of CCl_4 is high temperatures intense enough to regenerate the carbon, thereby stripping the CCl_4. Removing the fuel sources that could support a fire intense enough to strip the CCl_4 eliminates the only credible postulated mechanisms for a release that would result in consequences to the uninvolved individual and the public exceeding the threshold limit values (TLV) for a low hazard operation.

The analysis also disclosed that concentrations of CCl_4 at 330 ft (100 m) from the work site could exceed the time weighted average (TWA) limit. An operational safety limit (OSL) has been established indicating the requirements needed to mitigate the potential consequences to the uninvolved worker. The following are the mitigating features:

1. Placement of a CCl_4 detector downstream of the final GAC canister that is set to alarm (production units are interlocked with the logic system to shut down the blower) if concentrations of CCl_4 exceed 25 p/m_v.

2. Flow rate meters, located upstream of the blower and downstream of the final GAC canister, will be in place and interlocked with the logic system to shut down the blower if there is a flow rate variance greater than 10%. Reliability of system (flow rate meters and logic system) must ensure instruments fail-safe to assure shutdown of the blower. Monitoring of flow rate meters will be required by operations personnel as prescribed in the work procedures if instrumentation cannot reliably detect a flow rate variance of greater than 10% (exceeding 10% variance will require shutdown of the VES). Constant monitoring (with instruments for detection of CCl_4 vapors) of the portion of the VES (production units) under positive pressure is required if operating in by-pass mode (flow rate meters or logic system inoperable). Operation

of the VES characterization unit will require constant monitoring of the portion of the system under positive pressure. Detection of CCl_4 vapors with field instruments outside of the piping or canisters will necessitate immediate shutdown of the VES.

3. A minimum of two GAC canisters in place (two in series) to adsorb any CCl_4 if breakthrough of the first GAC canister occurs.

The controls in the form of an OSL can be found in Section 4.0.

The following recommended prudent actions are provided to minimize the probability of occurrence or the consequences of a release of CCl_4 to the receptor groups of concern: the occupational workers, uninvolved personnel, public, and the environment.

1. Monitor ambient air and worker's breathing zone for detection of CCl_4 vapors in areas where workers will be required to perform their work activities. Concentrations detected that exceed the TWA limits should require removal of personnel from the work area or donning of appropriate protective gear as required by the Job Safety Analysis (JSA) or Hazardous Operations Work Permit (HWOP).

2. Even though radioactive particulates are not expected to be removed during the remediation activities, in-line monitoring should be provided. In the event continuous air monitor (CAM) alarms indicate possible radioactive contamination, the process shall be shut down. Concurrence for restart will be required from the Health Physics supervisor. The characterization unit should be surveyed for any radioactive contamination before movement to another site. A record sampler should be used during operation of the characterization unit for confirmation of no airborne radioactivity.

3. Radon (^{222}Rn) gas monitoring equipment should be used to indicate the total quantities of ^{222}Rn and daughters adsorbed by the GACs during the VES operation. The quantities of ^{222}Rn measured will determine if the GAC canisters can be released from radiological controls. The ^{222}Rn gas concentrations of the stack effluent should be monitored.

4. A routine survey program should be implemented to monitor the GAC canisters for potential gamma exposures that may result from ^{222}Rn buildup in the canisters. If exposure rate exceeds 2mR/h outside the canisters, the area should be posted per the identified requirements in WHC-CM-4-10, *Radiation Protection Manual*.

5. The sites identified for remediation or site characterization work should be cleared of vegetation and combustibles not necessary to the project.

6. The electric generator should be located a minimum of 25 ft (8 m) from the propane storage tank as prescribed by fire code.

7. Replacement of existing in-line heaters should be with heater units that have a maximum air stream temperature capacity that does not exceed 400° F (205° C).

8. Whenever saturated GAC canisters are removed from the process, covers will be placed over the inlet and outlet ports of the canister and verified to be secure.

9. The components of the VES required for providing confinement of CCl_4 monitoring should be identified as Safety Class 3 components in a safety equipment list.

10. Provide notification to the fire department of the potential hazards involving CCl_4 in a fire and production of phosgene.

11. Employees assigned (drivers) responsibility for handling the saturated canisters must have completed hazardous material training.

12. Maintain a 50 ft (15 m) exclusion zone around the VES operations to prevent inadvertent access by uninvolved individuals at the work site.

13. The site workers should not come into close proximity to the heaters during periods of operation. The maximum air stream temperatures of 400° F (205° C) is required to be maintained. The temperatures within one inch of the heater cal rod may exceed the 400° F (205° C) resulting in some production of phosgene. The site workers should be made aware of potential hazards associated with the operation of the heaters during VES operations. Heater will be shut down when the blower is not running or the individual hose line is not in use.

14. Emergency response kit should be available at the site for containment of any spills. Notification (dial 811) should be made in the event of a spill.

15. During the GMSS test no more than one drum containing up to a maximum of 115 L (30 g) of liquid CCl_4 should be located at the work site. Remove loaded drum from the work site before continuing GMSS test.

16. Emergency notification responsibilities and response actions should be addressed in the emergency plans for the work sites where CCl_4 remedial activities are planned and in the emergency plans for the adjacent affected facilities or activities.

2.0 WORK DESCRIPTION

2.1 LOCATION AND DESCRIPTION OF DISPOSAL SITES

This section provides descriptions of disposal sites that were the principle contributors of the inventory of contamination to the soil and ground water (DOE-RL 1991). Figures 1 and 2 provide a basic site orientation. Figure 3 provides the location of the three PFP waste discharge sites.

Past waste disposal practices included the discharge of actinide-bearing liquid waste, generated from plutonium purifying processes, directly to the ground via structures called cribs. The PFP disposed of liquid CCl_4-bearing organic solvents and associated high salt, acidic aqueous wastes primarily to three waste sites from 1955 to 1973 (when solvent discharge to soil was stopped): the 216-Z-9 Trench, the 216-Z-1A Tile Field, and the 216-Z-18 Crib.

2.3.6 Demography

The HMS is used as the population reference point for the PFP area because of the availability of data and its proximity. About 36 people live within a 10 mi (16 km) radius of the HMS with all of these individuals being located west-southwest of the HMS. There are no residents within the Hanford Site boundary. Within this boundary only DOE, contractor personnel, or other authorized persons travel in areas beyond the Wye and Yakima Barricades. The closest resident to the 216-Z-9 Trench, 216-Z-1A Tile Field, and the 216-Z-18 Crib areas is 7.7 mi (12.5 km) due west at a Cold Creek ranch near State Highway 24 to Yakima. The nearest uninvolved workers are at the PFP and the patrol headquarters which are located 330 ft (100 m) from the 216-Z-9 Trench and 492 ft (150 m) from the 216-Z-18 Crib and 216-Z-1A Tile Field.

2.4 ACTIVITY DESCRIPTION AND PURPOSE

The purpose and objective of this activity is to mitigate further CCl_4 soil and ground water contamination in the 200 West Area. The VES process will remove CCl_4 and other volatile organic soil gases from the contaminated vadose zone soil.

The VES process will use existing or new wells for removal of CCl_4. The existing wells were used to collect vapor and sediment samples to define the CCl_4 plume and radionuclide configurations beneath the cribs. Some of the wells that may be used for remediation work (near the crib sites where CCl_4 vapors were detected in 1991) are shown in Figure 6. Other wells where remediation activities may occur (CCl_4 vapors detected at these sites from 1987 to 1991) in the 200 West Area are shown in Figure 7. The configuration of a typical well that will be used for extraction operations is shown in Figure 8. New wells may be drilled (as part of the remediation activities) if site characterization identifies additional CCl_4 plume areas that cannot be extracted using existing wells.

The process extracts soil gas by vacuum pumping. The processing system of the VES provides a negative pressure to the well, drawing the surrounding soil vapors out of the soil. Because CCl_4 is volatile, the negative pressure and air flow in the zone of influence of an extraction well converts any liquid CCl_4 into the vapor phase. Thus, any liquid CCl_4 mixed with manmade radioactive contaminants will separate from the manmade radioactive contaminants and release through the wells as a vapor (Attachment A).

The processing equipment of the VES is mounted on trailers to provide mobility and versatility. The trailers are connected together by electrical lines, instrumentation lines, and hoses. The VES characterization unit will be used for sampling the concentrations of CCl_4 found in the vadose zone soils.

2.4.1 Power Requirements

Several generators provided power for the VES during the test phase. Electrical pole power will power the VES process system. A 1,000 gal (3,800 L) propane tank will fuel a trailer mounted electric generator. The primary use of the generator will be for supplying power to the VES characterization unit (used primarily for site sampling activities) in remote locations where electrical pole power may not be available.

2.4.2 Vapor Extraction and Filter System

An overview of the VES design is discussed in this section. A more detailed description is provided in the project supporting document (Green 1991). The VES smaller production unit design will have the same form and function as the full-scale remediation unit with two major differences. The smaller production unit will have a minimum of two GAC canisters in series for removal of the CCl_4 vapors, as opposed to a minimum of six GAC canisters that will be used in the full-scale remediation unit for removal and treatment of CCl_4 vapors. The smaller production unit will also operate at a maximum of 500 cfm while the full-scale remediation system will operate up to 1,500 cfm.

The HEPA trailer will filter the soil gas vapor stream before the vapor is collected in the GAC canisters (Figure 9).

The maximum operating vacuum will not exceed 10 in. of mercury (254 mm Hg).

The following are system components:

- Perforated wells that may be extraction and observation intervals.
- Extraction hoses heated to prevent condensate freezeup.
- HEPA trailer:

  - Four inlet manifold on the test unit and seven inlet manifold on the full-scale remediation unit.

  - Sample capability for soil gas upstream and downstream of the HEPA filter in a protective cabinet.

  - In-line instrumentation to measure and record well head pressures, air temperatures, differential pressures, vacuum, relative humidity, and flow rate.

  - HEPA filter housing containing a prefilter and two HEPA filters in series.

  - There may be a noncontact electric heater installed before the prefilter to raise the vented gas temperature and reduce its relative humidity.

  - Alpha and beta process CAMs located between the HEPA filters.

Instrumentation will connect to a Data Acquisition System (DAS). The DAS will control operations, alarms, and perform trend analysis.

2.4.3 Blower Trailer

The blower trailer shall provide the flow that extracts the soil vapor and pushes it through the GAC canisters. The purchase specifications for procurement of GAC canisters requires that these canisters are DOT approved units. A flow diagram with a description of the major parts associated with the blower trailer is identified in Figure 10.

The following are trailer components:

- A vacuum pump designed to produce a maximum of 750 cfm at 150 in. Wg. for the test unit.
- Vacuum pumps designed to produce a maximum of 1,500 cfm at 150 in. Wg. for the full-scale remediation unit.
- Outlet and return manifolds for flow to and from the GAC canisters.
- One series of a minimum of two 1,000 lbs (450 kgs) to a minimum of 2,000 lbs (900 kgs) GAC canisters for the test unit.
- Three parallel GAC canister series with a minimum of two 2,000 lbs (900 kgs) GAC canisters in series. Specifications require DOT approved canisters.
- In-line instrumentation to measure and record air temperature, pressure, vacuum, relative humidity, flow rates, ^{222}Rn gas and CCl_4 concentrations.
- A sample cabinet.
- A DAS that includes a computer, software for trend analysis, alarm logic, and control software.
- A record sampler located at a 20 ft (7 m) tall exhaust stack.

2.4.4 Vapor Extraction System Characterization Unit

Sampling activities will be conducted using a VES characterization unit for removal of CCl_4 vapors and monitoring of the gas stream using field instruments. These field instruments will be used at the well sites identified for characterization work to establish the concentrations of CCl_4 found at each borehole. The data accumulated will assist in determining the most likely areas where full scale remediation activities for removal of CCl_4 will be required in the future.

The VES characterization unit will be operated, typically during the day shift, with a crew in attendance at all times. The duration period for sampling at each borehole will be about one hour. The portion of the VES characterization unit that is under positive pressure will be continuously monitored (using field instruments) during periods of operation.

The VES characterization unit design consists of a maximum 60 cfm system with the following components:

- Sample capability for soil gas upstream and downstream of the HEPA filter.
- In-line instrumentation to measure vacuum, pressure, air, temperatures, differential pressures, relative humidity, and flow rates.

- In-line HEPA filter.

- Vacuum pump designed to produce a maximum of 60 cfm at 10 in. Hg.

- Two 2,000 lbs (900 kgs) GAC canisters for adsorbing CCl_4 vapors extracted during sampling activities.

A description of the specific components for the VES characterization unit is provided in Figure 11.

2.4.5 Gas Membrane Separation System

The GMSS test is designed to remove VOCs from the vacuum extracted air stream and condense it to a liquid form. The air stream will be obtained by tapping into the VES. The system will require about 35 scfm. The four primary pieces of equipment for this system consist of a compressor, condenser, membrane modules and vacuum pump. The system is a closed loop with a clean air stream being returned to the VES upstream of the GACs.

3.0 HAZARDS

3.1 BASES FOR HAZARDS CONSIDERED

An evaluation of the unmitigated intrinsic hazards associated with this project and the initiating events were assessed for their potential to create a source term release. This evaluation and inventory analysis identifies the potential accident events.

The results from the evaluations determined that process hazards involving a continuous release of CCl_4, heated CCl_4 or carbon, dropped canisters, vehicle accidents and fires involving fuel sources are credible. Natural force events such as high winds/missiles, seismic events, range fires, and lightning were considered to be credible. Process hazards involving regeneration of the carbon releasing CCl_4 were found to be incredible. Criticality was assessed and determined not to be credible as a result of the vacuum extraction operations. Natural force events involving a flood and tornado were considered to be of no significant impact or would not result in significant consequences, therefore not requiring further analyses. A basis for these conclusions is discussed in this section.

3.2 HAZARDS INVENTORY

This assessment addresses the hazards associated with removal and treatment of CCl_4 using the VES units. The dominant VES hazard inventory anticipated is CCl_4.

There are several other chemical contaminants found in the unsaturated zone around the three primary CCl_4 disposal sites. The contaminant distribution data comes from soil gas analysis, historical well log data, measurements of CCl_4 vapors in boreholes, soil analysis, and data collected during the VES test. The contaminant data is divided into two sections; the near field (includes the three primary CCl_4 disposal sites), and the far field (includes the 200 West Area).

The near field hazardous substances identified (before the VES test phase) were tributylphosphate, dibutyl butyl phosphonate, n-butyl alcohol (which is from possible hydrolysis of TBP), and chloroform (a CCl_4 degradation product) (DOE-RL 1991). The volatile organic compound (VOC) substances, along with CCl_4, will vaporize based on the vaporization pressures and temperatures.

The sample results from the test phase show that the VOC extracted were CCl_4 and 2-butanone with trace amounts of chloroform.

Far field soil samples identified other contaminants in the soils. The contaminants identified are: acetone, benzene, chlorobenzene, chloroform, 1,2-dichloroethane, 1,1-dichloroethylene, cis-1,2-dichloroethylene, trans-1,2-dichloroethylene, ethyl benzene, fluoromethane, methylene chloride, methyl isobutyl ketone, tetrachloroethylene, toluene, 1,1,1-trichloroethane, trichloroethylene, p-xylene, m-xylene, and o-xylene. Samples of these contaminants from various wells indicate that the concentrations are very low. These compounds were analyzed for but not detected during the test phase.

The radionuclides discarded to the cribs are identified in Table 1. The high concentrations of radionuclides were found in sediments located immediately below the crib. The high concentration of actinides at this location is possibly due to the filtering and ion exchange by sediments of plutonium oxide particles that were originally present in the waste stream (Attachment A). The concentration of plutonium and americium in sediments generally decreases with depth beneath the bottom of the crib. An increase in plutonium and americium concentration at depth is generally associated with an increase in the silt content of sediments or with boundaries between sedimentary units. The bulk of the actinide contamination appears to be contained within the first 50 ft (15 m) of sediments beneath the bottom of a disposal site. The maximum vertical penetration of plutonium and americium contamination (defined by the 10^{-2} nCi/g isopleth that is approximately 100 ft (30 m) below the bottom of the 216-Z-1A crib (Price 1979).

During the test phase ^{222}Rn gas was detected using spectral gamma energy logging. Readings at the outside walls of the GAC canisters showed that the GAC had collected ^{222}Rn and that the ^{222}Rn was decaying to form decay products ^{214}Bi and ^{214}Pb, both of which have short half-lives. The test could not determine if the ^{222}Rn was from naturally occurring uranium or from uranium waste.

9 6 1 2 9 0 3 1 6 4 4

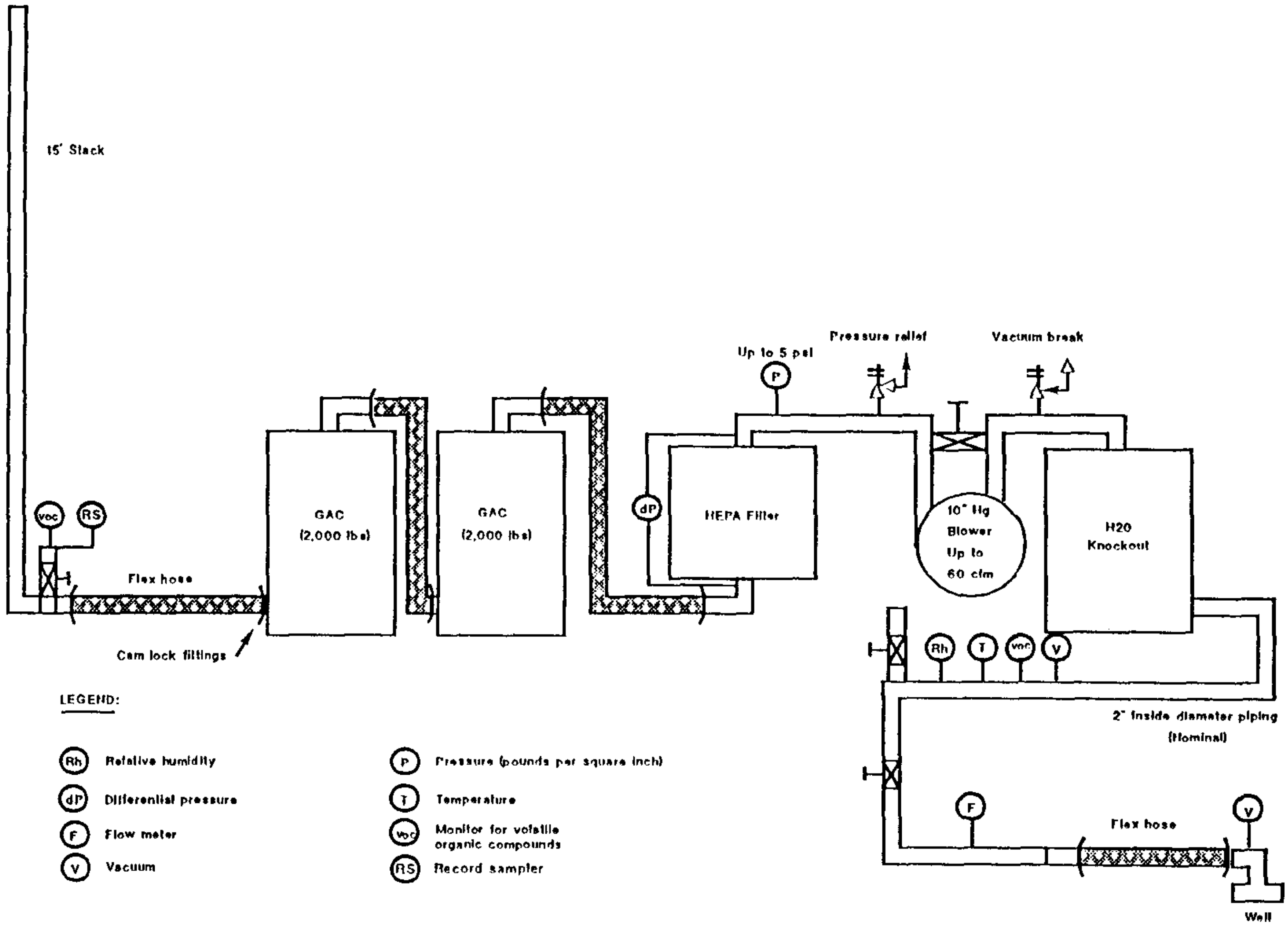

Figure 11. CCl_4 Vapor Extraction System Characterization Unit.

The test phase also indicated that the downstream GAC canister was found to emit higher gamma counts than did the upstream canister (2,500 counts per minute vs. 3,800 counts per minute using a thin window pancake geiger monitor (GM) probe on contact with the canister), which implied that the downstream canister contained more ^{222}Rn. The ^{222}Rn that was initially captured by the first GAC column would have been gradually displaced by the CCl_4 vapors, which have a greater affinity for carbon adsorption than ^{222}Rn. The displaced ^{222}Rn would migrate from the upstream canister and be captured by the downstream canister.

Atmospheric dispersion for ^{222}Rn emissions were calculated to determine if the ^{222}Rn concentration in the effluent can reach or exceed the Derived Air Concentration (DAC) limit (3.E-08 mCi/ml or 30 pCi/L) guides for controlling occupational intake through inhalation (DOE 1988a). The Derived Concentration Guide dose limit for ^{222}Rn emissions (3.E-9 mCi/ml) for members of the public was also considered for controlling intake through inhalation resulting from the VES operations (WHC-CM-7-5, *Environmental Compliance Manual*; DOE 1990). The calculations indicate it is unlikely that the emissions could be maintained at concentrations of 1 μCi/s without exceeding the DAC limit for the area surrounding the VES operations. Using the maximum operating flow rate of 1,500 cfm, the ^{222}Rn concentration in the effluent can reach 1.4E-06 μCi/mL (1412 pCi/L) before exceeding 10% of the DAC limit. It is unlikely that soil gas ^{222}Rn concentrations could reach the level necessary to maintain an emission rate of 1 μCi/s and would not exceed the threshold limits identified for low hazard category (Attachment B). An instantaneous release was also evaluated (Attachment B).

There could be gamma exposure problems if the ^{222}Rn buildup in the GAC canisters were to reach an exposure of 2 mR/h on the outside of the GAC canisters. During the test phase, the maximum gamma exposure readings identified were < 2 mR/h. Prudent actions are discussed in Section 4.3, addressing a exposure survey program and controls required in the event the contact exposure rate exceeds 2 mR/h and if any contamination is found due to any ^{222}Rn progeny contamination.

3.3 VAPORIZATION OF CONTAMINANTS

During the test phase, sample results indicated that there were only three chemical contaminants detected. The vapors extracted during testing consisted principally of CCl_4 and 2-butanone; however, 2-butanone may have resulted from laboratory contamination. Trace amounts of chloroform were also detected; the test assessment identified these contaminants as chemicals that were expected to be vaporized. Table 2 identifies the chemical contaminants expected to be vaporized and removed during the overall remediation phase.

Table 2. Chemical Contaminants Expected to be Vaporized During Remediation.

Chemical	Boiling Point	Vapor Pressures at 68° (20° C)
CCl_4	170°F (76.7°C)	1.7 lbs/in^2 (90 mm Hg)
Chloroform	140°F (61°C)	3.0 lbs/in^2 (160 mm Hg)
2-Butanone	175°F (79°C)	1.4 lbs/in^2 (71 mm Hg)

During the test phase, no radionuclides (other than ^{222}Rn) were detected during sampling of the GAC canisters, filters, or other portions of the system as expected (Attachments A and C).

3.4 CREDIBLE SCENARIOS ANALYZED

The predominant events are those associated with activities that would cause the contaminants to become airborne. There were several scenarios postulated that could cause a release of contaminants to the environment during normal operations or as a result of an accident. The analysis of the hazard inventories and the potential release mechanisms indicated that a continuous release of CCl_4 due to a system control or component failure would produce the maximum source term. All of the scenarios involve inventories of CCl_4 that could be released to the environment.

3.4.1 Process Hazards

Continuous Release:

This scenario illustrates the consequences associated with the recovery and release to the environment of CCl_4 (positive pressures blowing out CCl_4 around fittings, hole in a flex hose, saturation of carbon beds, etc.) during operations. This scenario encompasses any event that results in a continual release of CCl_4 as it is recovered (a control system or component failure, etc.) resulting in a source term to the receptor groups of concern. The source term identified for this scenario is 1.6 lb/min being released over a 24 h period. This is the bounding accident condition for this assessment.

Heated CCl_4 or Carbon:

In-line noncontact electric heaters will be used to reduce the humidity (condensation) in both the vacuum hoses and prior to entry, into the HEPA filters. The noncontact electric heaters were evaluated for their potential to heat the CCl_4, producing phosgene or regenerating the carbon releasing CCl_4.

The heater design indicates that 275° F (135° C) is the maximum air stream temperature capacity of the heater units at 50 acfm. Hydrolysis (production of phosgene) of CCl_4 could begin to occur if temperatures exceed 400° F (205° C) in the air stream. The maximum temperature capacity of the heating units are not sufficient to produce phosgene. Additional discussion is provided in Section 3.7.

The maximum temperature capacity of the heaters may support some regeneration of the carbon (located downstream in canisters) resulting in some CCl_4 desorption. An event involving desorption of the CCl_4 resulting in unacceptable consequences was found to be incredible based on the analysis (Attachment D).

Dropping Saturated Canisters During Changeout:

There is a possibility for a spill of CCl_4 due to dropping a fully loaded GAC canister during the process of changing out the canister. The CCl_4 inventory of 1,200 lbs (545 kgs) adsorbed on a 2,000 lb GAC unit is the maximum inventory; this is the highest possible saturation efficiency of the carbon. The carbon canister would be saturated with 1,200 lbs (545 kgs) of CCl_4. The source term would be 660 lbs (300 kgs), which is the quantity that would be desorbed when exposing the contents to an unimpeded air flow of 70° F (22° C) at 1 atm. If this event were to occur the consequences could result in concentrations of CCl_4 above the TWA limit but would still be far less than the immediately dangerous to life and health limit. The consequences of this scenario would be bounded by the scenario associated with a system control or component failure.

Vehicle Accident:

An accident involving a vehicle fire (fork truck used to change out canisters) in the extraction area near the GAC canisters was evaluated to determine the probability of occurrence. The analysis determined that a vehicle fire is credible but that the sequence probability of involving the GAC canisters in the fire providing sufficient heat to support regeneration of the carbon was not credible (Attachment E).

Fire Involving Propane Fuel Source:

A 1,000 gal propane fuel tank will be located a minimum of 50 ft (15 m) from the GAC canisters to provide fuel to an electrical generator that will be used primarily for powering the VES test unit. The generator will be located a minimum of 25 ft (8 m) from the GAC canisters.

An analysis was developed based upon a fire incurred due to refueling the propane tank, a fire resulting from equipment damage to the propane tank, a fire involving a vehicle accident in close proximity to the propane tank, and a fire involving the generator.

Even though the analysis indicates that these initiating events are credible, the sources of fire in relationship to the generator and fuel storage area to the configuration of the canisters (accumulation in storage or location in the VES process) indicate that a significant release of CCl_4 because of a fire (heating up and regenerating the carbon releasing CCl_4) is considered to be incredible (Attachment E).

3.4.2 Natural Force Events

High Winds/Missiles:

There is a remote possibility that high winds may cause airborne missiles (scrap wood, miscellaneous items around the sites, etc.) to be carried through the air, striking and penetrating a section of flex hose or a canister. The resulting release due to a ruptured air hose would be bounded by the analysis addressing a continuous release. The release of any carbon particles are not likely to cause unacceptable consequences to the receptor groups of concern because 95% of these particles are not considered to be respirable.

Seismic Event:

If a seismic event occurs, the worst case consequences would most likely result from a continuous release of the CCl_4 if the system continued to operate. The analysis for a continuous release (Table 5) would bound the scenario (damage to the VES due to a seismic event), releasing CCl_4 continuously. The VES is designed to extract CCl_4 vapors from soils (vadose zone) and is not required to operate in order to provide confinement. If the system is damaged and is not operable, the extraction of CCl_4 would not be possible. Any damage to the canisters may result in some desorption of CCl_4 if the contents are exposed to an unimpeded air flow. The consequences resulting from desorption of the CCl_4 would be bounded by the scenario addressing a system control or component failure.

Range Fires:

Range fires were evaluated and determined to be credible. The probability associated with the fire affecting the canisters (duration of fire and sufficient heat to support regeneration of CCl_4) was found to be incredible (Attachment E).

Lightning:

Thunderstorms have been observed at the HMS nearly every month of the year but are very rare during the winter months. Although severe thunderstorms are rare, the site is vulnerable to lightning strikes that occur typically in the months of July or August. If a lightning strike occurs at the work site, damaging piping or a GAC canister, the worst case consequences would be bounded by the analysis addressing a continuous release.

3.5 EVENTS CONSIDERED INCREDIBLE

3.5.1 Process Systems or Materials

Regeneration of Carbon:

The potential consequences of an accident involving regeneration of the carbon resulting in CCl_4 desorption was evaluated and found to be incredible. Accidental regeneration was based upon fresh air desorption (based upon experimental data and data from the carbon supplier) of the CCl_4 contained on the carbon. Desorption of CCl_4 resulting in consequences to the receptor groups of concern or the environment was found not to be credible (Attachment D).

Criticality:

The criticality safety issues involving the VES process were evaluated prior to the VES test to ascertain whether some of the plutonium bearing waste solutions (discarded in the past to the three crib disposal sites) could possibly be vaporized and draw off plutonium with the gases.

The VES technique for extracting CCl_4 from the soil below the crib did not draw off any plutonium with the gases as expected during the test phase. The discussion provided in Attachments A and C indicate that removal of plutonium in the gases or redistribution of the material trapped in the soil would not occur. The criticality prevention specification was revised and approved by criticality engineering for allowing vapor vacuum extraction operations at the crib sites for the overall remediation activities (Attachment F).

3.5.2 Natural Forces Events

Flood:

The Columbia River probable maximum flood elevations (the flood discharge that may be expected from the most severe combination of meteorologic and hydrologic conditions reasonably possible in the region) would be about 425 ft (130 m) at the 100-N Area (with respect to msl). This flood would not affect the central part of the site (the 200 East/West Areas plateau), where the cribs are located because this area has an elevation greater than 500 ft (150 m). Similarly, waters of the 100-yr flood would have no effect on this area. A flood affecting this site having significant adverse effects is therefore considered incredible.

Tornado:

A severe tornado of the Midwest type is highly unlikely under the climatologic and orographic conditions of the Pacific Northwest. There have been only two tornado funnel clouds and one small tornado (June 16, 1948) observed at the Hanford Site in the 34-yr period between 1945 and 1978. Although one of these touched ground, it caused no damage. The nearest reported tornado damage was in Yakima (April 30, 1957), about 45 mi to the west, and at Wallula Junction (June 26, 1958), about 50 mi to the southwest. Only minor damage was noted. The potential consequences in terms of airborne concentrations have been found below risk acceptance consequences (WHC-CM-4-46, *Nonreactor Facility Safety Analysis Manual*).

3.6 THRESHOLD VALUES

The inventory and resulting source terms were analyzed for CCl_4. The other VOCs that were extracted during the test phase (based upon the temperatures required to vaporize these contaminants) were 2-butanone and trace amounts of chloroform. Because these other contaminants are present in much lower quantities than that of CCl_4, and the toxicity of both chloroform and 2-butanone are less than CCl_4, these contaminants are bounded by the CCl_4 analysis.

The toxicity limit values for the chemical contaminants identified in this section are provided in Table 3. These limits were derived from the guidelines using the concentration values reported in the American Conference of Governmental Industrial Hygienists Threshold Limit Values for Chemical Substances and Physical Agents and the Occupational Safety and Health Administration, Department of Labor Standards (ACGIH 1990; 29 CFR 1910).

Table 3. Toxicity Limit Values.

Inventory of contaminants	IDLH		TWA		STEL	
	p/m	mg/m^3	p/m	mg/m^3	p/m	mg/m^3
2-Butanone	3,000	8,847	200	590	300	885
Carbon tetrachloride*	300	1,887	2	13	--	
Chloroform*	1,000	4,883	2	10	--	

IDLH = The Immediately Dangerous to Life or Health level represents a maximum concentration from which one could escape within 30 min without any escape-impairing symptoms or any irreversible health effects.

TWA = The Time-Weighted Average concentration limit for a normal 8-h workday and a 40-h workweek, to which nearly all workers may be repeatedly exposed, day after day, without adverse effect (The term "TWA" may be expressed in either p/m or mg/m^3).

STEL= The Short-Term Exposure Limit is a 15-min TWA exposure that should not be exceeded at any time during a workday.

* Ca = Any chemical designated as "Ca," is considered to be a chemical that should be treated as an occupational carcinogen.

3.7 ASSESSMENT SUMMARY

This assessment analyzed CCl_4 as the hazardous inventory of concern because CCl_4 is the predominant contaminant found during the test phase as discussed in the ERA proposal (DOE-RL 1991). Scenarios were analyzed and the results are provided in order to determine the potential consequences associated with these events. The worst case consequences have been identified and are addressed in this section.

The requirements for determination of hazard classification indicates that this activity will require review and approval for that of a low hazard operation. This safety assessment satisfies the requirements of WHC-CM-4-46, Kerr 1990, and DOE Order 5481.1B, *Safety Analysis and Review System* (DOE 1988b). The requirements considered also included the protective action guidelines (PAG) that were developed to limit inhalation exposures to the public to levels below which they would not be expected to experience or develop irreversible or other serious health effects or symptoms that could impair their ability to take appropriate protective action (WHC-CM-4-1, *Emergency Plan*).

The hazard classification criteria for this activity complies with the procedural criteria of WHC-CM-4-46 and is consistent with the guidance in Kerr 1990. Because CCl_4 is not defined in PAG concentrations (WHC-CM-4-1) or in the emergency response action guidelines in Kerr 1990, concentrations with conservative fractions of IDLH is used as the criteria. Onsite criteria and offsite criteria for low hazard is <0.1 of the IDLH [30 p/m CCl_4

(Kerr 1990)] and < TLV-TWA [2 p/m CCl_4 (WHC-CM-4-46)], respectively.

The assessed consequences have been evaluated against the toxicological risk acceptance curve. The potential concentrations of CCl_4 are within the acceptance guidance (WHC-CM-4-46).

The receptors of concern are the nearest onsite and offsite individuals. The closest onsite facility to the remediation sites is the PFP. The nearest offsite location is Highway 240, 2.8 mi (4.5 km) southwest of the 216-Z-18 crib. The site boundary (nearest resident) is 7.7 mi (12.5 km) southwest of the crib sites.

The bounding postulated scenario involves the rupturing of three fully saturated canisters releasing CCl_4 resulting in consequences to the receptors of concern. This scenario involves a vaporization rate of 2.0 lb/min of CCl_4 with the CCl_4 vapors being released over a period of 16 h. A summary of the receptor exposures for this scenario is provided in Table 4.

Table 4. Receptor Exposures Due to Release of 2.0 lbs/min of CCl_4 Over 16 h.

Release of CCL_4 per min over a 16-h period (lbs)	Resultant Exposures			Limits	
	Onsite (100 m)	Nearest public access (4.5 km)	Offsite	IDLH	TWA
2.0	28 p/m 176 mg/m^3	0.14 p/m 0.88 mg/m^3	0.05 p/m 0.32 mg/m^3	300 p/m 1,882 mg/m^3	2 p/m 13 mg/m^3

Attachment G provides the data that includes the analysis for the receptor exposures identified in Table 4.

One postulated scenario identified the worst-case production of phosgene gas near heating units in the GAC system. There will be heaters located in the hoses that connect the well head to the GAC system (usually one heater per well), prior to the prefilter, located upstream of the HEPA filtration system. The heaters should not provide sufficient temperatures to heat the GAC units that result in the production of phosgene (hydrolysis could begin to occur if temperatures exceed 400° F (205° C) in the air stream) as indicated in Attachment H, because the in-line heater design will have a maximum air stream temperature capacity of 275° F (135° C) at 50 acfm.

Table 5 provides the consequences if sufficient temperatures could be achieved for phosgene production. The conversion rate of CCl_4 to phosgene assumes temperatures of 1100°-1400° F (600°-760° C) that are required for a much larger conversion (CCl_4 hydrolysis reaction goes to completion or near completion) of CCl_4 to phosgene. The conversion rate is 2.7E-4 lbs phosgene produced per lb of CCl_4 exposed to the stated temperatures in the presence of oxygen. Other assumptions show that phosgene produced is also vented to the environment without being adsorbed in the GAC unit, and the phosgene produced does not undergo hydrolysis as the temperature decreases.

Even if sufficient temperatures are achieved, the consequences would not exceed the limits for a low hazard activity (Table 5), but the TWA limit for exposure to phosgene could be exceeded for the site worker. Prudent actions are recommended in Section 4.3, addressing the maximum air stream temperature capacity for the heaters.

Table 5. Phosgene Production Near Upstream and Prefilter Heaters.

Flow of CCl_4 per min (lbs)	Resultant Exposures			Limits		
	Onsite (100 m)	Nearest public access (4.5 km)	Offsite (12.5 km)	IDLH	TWA	Ceiling* limit
1.6	.007	1.2E-5	4E-6	2 p/m 8.22 mg/m^3	0.01 p/m 0.04 mg/m^3	0.02 p/m 0.8 mg/m^3

* Ceiling limit = A permissible 15 min TWA excursion limit above the 8 hr TWA limit that should not be exceeded during any part of the workshift.

Attachment G provides the data that includes the analysis for the receptor exposures identified in the above table.

The consequence analysis also indicated that several postulated scenarios could result in consequences to the site and nearest uninvolved worker that exceeds the OSHA limits for exposure to CCl_4. Table 6 identifies the system or component failures, consequences as a result of those failures and mitigative features available to reduce or eliminate the potential consequences to the site worker and nearest uninvolved worker.

Those components designed for providing or maintaining confinement of the VES are defined as safety class 3 components (WHC-CM-1-3, *Management Requirements and Procedures*). The consequences of this operation could affect the health and safety of the site workers due to accidental releases of chemicals.

The VES production and characterization units are located in closer proximity to the PFP than has been analyzed in the PFP accident analysis. The CCl_4 workers located within the PFP safety envelope are required to be trained for emergency response actions to those accidents at PFP that may result in any potential consequences to the VES work sites. The PFP Final Safety Analysis Report discusses the accidents and potential consequences to the site worker, onsite worker, and the public (Carlson 1990).

Table 6. Assessment of Hazards and Controls.

Component Failure and Consequences	Mitigation
Failure of piping (hole in a flex hose), fittings, saturation of both the GAC canisters causing CCl_4 to breakthrough, or failure of a control system could cause a continuous release resulting in consequences to the uninvolved individual. Concentrations of CCl_4 at 330 ft (100 m) would be a maximum of 17 p/m.	A calibrated VOC detector should be installed downstream of the final GAC canister for detection of CCl_4. The alarm set point of the detector should be set for concentrations of 25 p/m_v of CCl_4 and should also be interlocked to shutdown the blower if the 25 p/m_v concentrations of CCl_4 are exceeded. Personnel who operate the VES characterization unit should be trained to monitor and shut down the blower in the event the 25 p/m_v is exceeded. Flow rate meters, located upstream of the blower and downstream of the final GAC, should be calibrated to indicate a flow rate variance of not more than 10% above the combined accuracy between the meters. The flow rate meters should also be interlocked to shut down the blower if a greater than 10% variance above the combined accuracy of the two flow rate meters is detected. Reliability of system must ensure instruments fail-safe to assure shutdown of the blower. Constant monitoring of the VES (as prescribed in the work procedures) is required if operating in by-pass mode or if operating the VES characterization unit. Detection of CCl_4 vapors with field instruments outside of the piping or canisters will necessitate shutdown of the VES. A minimum of two GAC canisters in series should be in place at all times with the final GAC canister having $\geq$ adsorptive capacity than the unit immediately upstream.

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Table 6. Assessment of Hazards and Controls (Cont).

Component Failure and Consequences	Mitigation
Spill of carbon involving three GAC canisters (as a result of a rupture due to dropping a canister) that results in consequences to the uninvolved individual. Maximum concentrations of CCl_4 at 330 ft (100 m) would be 28 p/m.	An emergency response kit should be available for containment of a spill. Immediate notification to hazardous material response team using the 811 emergency notification system should be made in the event of a spill.
In-line heaters that have a maximum air stream temperature capacity of 275° F (135° C) at 50 acfm. The heaters will be used to remove moisture in the process flow stream. Hydrolysis of CCl_4 can occur (resulting in the production of some phosgene gas) due to heating the process flow stream to temperatures that exceed 400° F (205° C). A fuel fire that occurs in close proximity to the saturated GAC canisters providing sufficient temperatures to cause regeneration of the carbon. The heat from the fuel fire would strip and release the toxic pollutants in the smoke plume within a 30 min period.	Replacement of failed heater units should be with units which do not exceed a maximum air stream temperature capacity of 400° F (205° C). Locating the fuel sources a minimum of 50 ft (15 m) away from the GAC canisters whether the canisters are in storage or being used in the process. Locating the generator a minimum of 25 ft (8 m) away from the GAC canisters. Maintaining the fuel sources and generator at the specified distances allows adequate clearance for flames that could result from a failure of the propane tank or fuel hose to the generator. This would provide a conservative distance at which flames could affect the CCl_4 canisters.

The mitigation features and controls required to assure concentrations to the site and nearest uninvolved worker are controlled below the OSHA limit for CCl_4 (identified in Table 6) and are discussed in Section 4.0.

4.0 SAFETY FUNCTIONS AND CONTROLS

The analysis disclosed that the VES remediation operations would be classified as a low hazard operation. The safety functions that will be provided for the remediation activities of the CCl_4 VES process are identified in OSLs. The following are the OSLs for the 200 West Area CCl_4 ERA.

4.1 OPERATIONAL SAFETY LIMIT 1 - FUEL SOURCES

4.1.1 Title - Inventory control of fuel sources.

4.1.2 Applicability - This OSL applies to the location of the 1,000 gal propane storage tank, fuel trucks that may be used for refueling the fuel tank and the electric generator at the site. (This limit does not apply to the fork truck or similar equipment having small quantities of fuel).

4.1.3 **Objective** - The objective of this OSL is to assure that a common mode fire affecting the propane tank, fuel truck, or generator would not provide sufficient temperatures that could affect the GAC canisters resulting in regeneration of CCl_4 causing unacceptable consequences to individuals.

4.1.4 **Requirements** - a. The propane fuel tank or a fuel truck for refueling the propane tank shall be located a minimum of 50 ft (15 m) from the GAC canisters whether the canisters are in storage or being utilized in the process.

b. The generator shall be located a minimum of 25 ft (8 m) from the GAC canisters.

c. A maximum of not more than twelve fully saturated canisters will be allowed per storage location at the work site.

4.1.5 **Surveillance** - The responsible operating organization shall verify daily (prior to startup and during periods of operation) that the work site is in compliance with the requirements of this OSL. Compliance with the stated requirements shall be documented in an auditable record.

4.1.6 **Recovery**

4.1.6.1 **Non-compliance with the requirements of the OSL:**

1. VES operations shall cease until Health and Safety Assurance approves restart of the operation.

2. The fire department will be notified requesting standby at the work site until full recovery actions are completed.

3. The location of the fuel source shall be re-established at a minimum of 50 ft (15 m) as soon as reasonably possible.

4. The location of the electric generator shall be re-established at a minimum of 25 ft (8 m) as soon as reasonably possible.

5. The number of saturated canisters in storage shall be reduced to twelve as soon as reasonably possible.

6. The OSL violation shall be documented as an unusual occurrence report.

4.1.6.2 **Non-compliance with the surveillance requirement:**

1. The surveillance shall be performed immediately.

2. If surveillance determines non-compliance with the requirement, the recovery actions identified in Section 4.1.6.1 shall be initiated.

3. Failure to implement a surveillance requirement shall be documented as an off-normal occurrence.

4.1.7 **Audit Point** - An auditable log shall be maintained at the site documenting the results of the surveillance. This log shall be reviewed weekly by the operating organization assuring compliance with the requirements and surveillance. The audit and surveillance frequencies shall be determined by the Quality Assurance and Environmental Assurance organizations respectively.

4.1.8 **Basis** - The minimum 50 ft (15 m) separation between the propane tank and the CCl_4 canisters, whether in storage or being used at the VES production and characterization units, and a minimum 25 ft (8 m) separation between the generator and the canisters allows adequate clearance for flames that could result from a failure of the propane tank or the fuel hose to the generator. This would provide a conservative distance at which a flame could affect the CCl_4 canisters. The primary cause of a release of CCl_4 is high temperature. Removing the only potential fuel sources (1,000 gal propane tank, fuel carried by a fuel truck) for a fire intense enough to strip the CCl_4 eliminates the credible postulated mechanisms for releasing the CCl_4 causing consequences to the receptors of concern or the environment exceeding the TLV for a low hazard operation. The analysis involving other accidents in this assessment were based upon six saturated canisters that are part of the VES and twelve saturated canisters in a storage area. An accident involving not more than twelve saturated canisters, in storage, would ensure the integrity of this assessment.

4.2 OPERATIONAL SAFETY LIMIT 2 - LIMITING CCl_4 EXPOSURES TO THE NEAREST UNINVOLVED INDIVIDUAL

4.2.1 **Title** - Controlling the concentrations of CCl_4 to the nearest uninvolved individual to below the permissible exposure limit.

4.2.2 **Applicability** - This limit applies to mitigating the consequences of a release of CCl_4 below the OSHA 8 h TWA limit of 2 p/m_v to the nearest uninvolved individual during VES operation.

4.2.3 **Objective** - The objective of this limit is to assure that the concentrations of CCl_4 from the VES operation do not exceed the OSHA limit causing unacceptable consequences to individuals.

4.2.4 **Requirements** - a. A CCl_4 detector, used as the final exhaust monitor, shall be located downstream of the final GAC. The detector shall be set to alarm at 25 p/m_v CCl_4 concentrations and shall be interlocked to shut down the blower (on the production units) if the 25 p/m_v CCl_4 concentrations are exceeded. Annual average shall be $\leq$ 2 p/m based on equipment run time. Personnel who operate the VES characterization unit shall be trained to monitor and shut down the blower in the event the 25 p/m_v is exceeded.

b. The flow rate meters, located upstream of the blower and downstream of the final GAC, shall be calibrated.

9 5 1 3 0 0 1 1 9

A logic system shall be in place to initiate a system shutdown (system shutdown within one min) when flow rate variance is greater than 10% above the combined accuracy of the flow rate meters. Reliability of system (flow rate meters and logic system) must ensure instruments fail-safe to assure shutdown of the blower. Monitoring of flow rate meters will be required by operations personnel as prescribed in the work procedures if instrumentation cannot reliably detect a flow rate variance of greater than 10% (exceeding 10% variance will require shutdown of the VES). Constant monitoring (with instruments for detection of CCl_4 vapors) of the portion of the VES under positive pressure is required if operating in by-pass mode (flow rate meters or logic system inoperable) or if operating the VES characterization unit. Detection of CCl_4 vapors with field instruments outside the piping or canisters will necessitate immediate shutdown of the VES.

c. There shall be a minimum of two GAC canisters in series. The final GAC canister shall have equal to or greater adsorptive capacity than the unit immediately upstream in order to adsorb any CCl_4 in the event breakthrough of the first GAC canister occurs.

4.2.5 Surveillance - a. A weekly operability check and monthly system functional check of the CCl_4 exhaust detector and flow meters, located upstream of the blower and downstream of the final GAC canister, shall be conducted by the responsible operating organization. Test data shall be recorded and documented in an auditable record. Personnel training shall be verified for those individuals responsible for operating the VES characterization unit prior to initial startup.

b. Prior to startup of operations and during changeout of saturated canisters, the responsible operating organization shall verify that the final GAC canister shall have equal to or greater adsorptive capacity than the unit immediately upstream. The verification shall be documented in an auditable record.

c. Quarterly trending should be conducted to verify that the concentrations are below the 2 p/m average.

4.2.6 Recovery

4.2.6.1 Non-compliance with the requirements of the OSL:

1. Once a determination is made that the operating organization is not in compliance with the requirements of this OSL, operations shall immediately cease. The approval of Health and Safety Assurance will be required for restart of the operation.

2. Failure of the CCl_4 detector and/or logic system to initiate shutdown (if concentrations of CCl_4 exceed 25 p/m_v) shall require maintenance troubleshooting and repair prior to restart of the operation. Failure to operate the VES characterization unit with trained personnel shall require shutdown of sampling operations until trained personnel are provided.

3. Failure of the flow rate meters and/or logic system to initiate shutdown (if a flow rate variance greater than 10% above the combined accuracy of the two flow rate meters is found) shall require maintenance troubleshooting and repair prior to restart of the operation.

4. Failure to have a final GAC canister in place (with equal to or greater adsorptive capacity than the unit immediately upstream) shall require a unit be installed prior to resumption of operations.

5. The OSL violation shall be documented as an unusual occurrence report.

4.2.6.2 Non-compliance with the surveillance requirements:

1. The surveillance shall be performed immediately.

2. If the surveillance determines noncompliance with the requirement then initiate recovery actions as identified in Section 4.2.6.1.

3. Failure to implement a surveillance requirement shall be documented as an off-normal occurrence.

4.2.7 Audit Point - An auditable log shall be maintained at the site documenting the results of the surveillance. This log shall be reviewed weekly by the operating organization and audit and surveillance frequencies determined by Quality Assurance and Environmental Assurance respectively, assuring compliance with the requirements of the surveillance.

4.2.8 Basis - Limiting the concentrations of CCl_4 to below the OSHA 8 h TWA limit to the nearest uninvolved worker assures exposures to occupational carcinogens are maintained at levels that will reduce or eliminate adverse health effects to personnel. Trending allows forecasting and evaluation or identification of potential upset conditions that may result in exceeding the annual average.

4.3 PRUDENT ACTIONS

Function 1 - Minimize occupational workers' exposures of VOC to as low as reasonably achievable.

Prudent Action 1 - Monitor ambient air and workers' breathing zone for CCl_4 vapors in areas where workers will be required to perform their work activities. Concentrations detected that exceed the TWA limits should require removal of personnel from the work area or donning of appropriate protective gear as required by the JSA or HWOP.

Function 2 - Monitor VES for potential radionuclide particulate contamination.

Prudent Action 2 - Even though radioactive particulates are not expected to be removed during remediation activities, provide monitoring for radioactive contamination. In the event CAM alarms indicate possible radioactive contamination, shut down the process. Concurrence for restart will be required from the Health Physics supervisor. The characterization unit should be surveyed for any radioactive contamination before movement to another site. A record sampler should be used during operation of the characterization unit for confirmation of no airborne radioactivity.

Function 3 - Monitor for ^{222}Rn.

Prudent Action 3 - The ^{222}Rn monitoring equipment should be used to indicate the total quantities of ^{222}Rn and daughters adsorbed by the GACs during the VES operation. The quantities of ^{222}Rn measured will determine if the GAC canisters can be released from radiological controls. The ^{222}Rn concentrations of the stack effluent should be monitored.

Function 4 - Survey program.

Prudent Action 4 - A routine survey program should be implemented to monitor the GAC canisters for potential gamma exposures that may result from ^{222}Rn buildup in the canisters. If the exposure rate exceeds 2mR/h on contact with the outside of the canisters, the area will be posted per the requirements identified in WHC-CM-4-10.

Function 5 - Assure remediation and characterization sites are free of vegetation and combustibles.

Prudent Action 5 - The sites identified for remediation or site characterization will be cleared of vegetation and combustibles not necessary to the project.

Function 6 - Location of generator.

Prudent Action 6 - The electric generator should be located a minimum of 25 ft (8 m) from the propane storage tank as prescribed by the fire code.

Function 7 - Controlling the size (temperature capacity) of the in-line heaters used in the VES design.

Prudent Action 7 - Replacement of failed in-line heaters should be with heater units that have a maximum air stream temperature capacity that does not exceed 400° F (205° C).

Function 8 - Capping of the canister ports.

Prudent Action 8 - Whenever saturated GAC canisters are removed from the process, covers will be placed over the inlet and outlet ports of the canister and verified to be secure.

Function 9 - Establish safety equipment list.

Prudent Action 9 - The components of the VES required for providing confinement of CCl_4 and monitoring should be identified as Safety Class 3 components in a safety equipment list.

Function 10 - Apprise fire department of hazards.

Prudent Action 10 - Provide notification to the fire department of the potential hazards involving CCl_4 in a fire and production of phosgene.

Function 11 - Training.

Prudent Action 11 - The employees (drivers) who are assigned responsibility for handling the saturated GAC canisters must have completed hazardous material training.

Function 12 - Exclusion zone.

Prudent Action 12 - Maintain a 50 ft (15 m) exclusion zone around the VES operations to prevent inadvertent access by uninvolved individuals to the work site.

Function 13 - Personnel exposure to heaters during operations.

Prudent Action 13 - The site workers should not come into close proximity to the heaters during periods of operation. The maximum air stream temperatures of 400° F (205° C) is required to be maintained. The temperatures within 1 in. of the heater cal rod may exceed the 400° F (205° C) resulting in some production of phosgene. The site workers should be made aware of potential hazards associated with the operation of the heaters during VES operations. Heater will be shut down when the blower is not running or the individual hose line is not in use.

Function 14 - Minimize consequences of spilled carbon with CCl_4.

Prudent Action 14 - An emergency response kit should be available on site for containment of spill. If a spill occurs, notify 811 requesting response by hazardous material response team.

Function 15 - Inventory control of liquid CCl_4 at the GMSS test site.

Prudent Action 15 - During the GMSS test no more than one drum containing up to a maximum of 115 L (30 g) of liquid CCl_4 should be located at the work site. Remove loaded drum from the work site before continuing GMSS test.

Function 16 - Notification and emergency response actions.

Prudent Action 16 - Emergency notification responsibilities and response actions should be addressed in the emergency plan for the CCl_4 work site and in the emergency plans for the adjacent affected facilities.

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WHC-CM-4-1, *Emergency Plan*, Section 4.0, "Emergency Conditions," Westinghouse Hanford Company, Richland, Washington.

WHC-CM-4-10, *Radiation Protection Manual*, Westinghouse Hanford Company, Richland, Washington.

WHC-CM-4-46, *Nonreactor Facility Safety Analysis Manual*, Westinghouse Hanford Company, Richland, Washington.

WHC-CM-7-5, *Environmental Compliance Manual*, Appendix A, "Derived Concentration Guides for Controlling Exposure to Members of the Public," Westinghouse Hanford Company, Richland, Washington.

2.1.1 216-Z-9 Trench

The 216-Z-9 Trench operated from 1955 to 1962 to receive all PFP Recuplex facility solvent and aqueous wastes discharged to the soil. The 216-Z-9 Trench is an enclosed earthen trench, located about 705 ft (215 m) east of the PFP. The trench excavation base is 60-by-30 ft (18-by-9 m) and 20 ft (6 m) deep. The surface is a 120-by-90-by-0.75 ft (36.5-by-27-by-0.23 m) thick concrete trench cover at ground level. Six 23 ft (7 m) tall concrete columns support the cover. Waste was transferred by gravity through one of two 1.5 in. (4 cm) stainless steel pipes which entered the trench about 16 ft (5 m) above its bottom.

2.1.2 216-Z-1A Tile Field

The 216-Z-1A Tile Field operated from 1949 to 1959 to receive overflow liquid waste from three adjacent cribs. The waste stream consisted of neutral to basic (pH 7 to 10) process waste and analytical and development laboratory waste from PFP via the 241-Z-361 Settling Tank. Use of these four disposal facilities stopped in 1959. The 216-Z-1A Tile Field was reactivated in 1964 to receive aqueous and organic waste directly from the Plutonium Reclamation Facility (PRF).

Between 1964 to 1969, the tile field was divided into three working sections (Z-1AA, Z-1AB, and Z-1AC) to prevent waste buildup at the northern end of the field. No other facility received PRF wastes from 1964 to 1969 except on two brief occasions during tile field effluent piping upgrades. During this time the PRF wastes were discharged to the 216-Z-1 and-216-Z-2 cribs, located immediately north of the tile field.

HAZARDS ASSESSMENT OF THE CARBON TETRACHLORIDE SAMPLING ACTIVITIES USING THE NEW 60 CFM VACUUM SAMPLING UNIT

D.K. Oestreich

D. K. Oestreich, Engineer, Radiological and
Toxicological Analysis Group

1.0 INTRODUCTION

This document provides an assessment of potential hazards relating to the use of a characterization sampling unit (shown in Figure 1) for characterization of soil gases that are drawn from various extraction wells located in the 216-Z Crib areas south and east of the Plutonium Finishing Plant exclusion area. The extraction well locations are placed in a manner one would expect analysis of gases extracted would provide a basis for selection of the optimum location for the placement of full size extraction units for soil remediation. This document does not cover the boring of the extraction wells because the wells that are to be sampled are already in existence.

2.0 CHARACTERIZATION SAMPLING UNIT DESCRIPTION

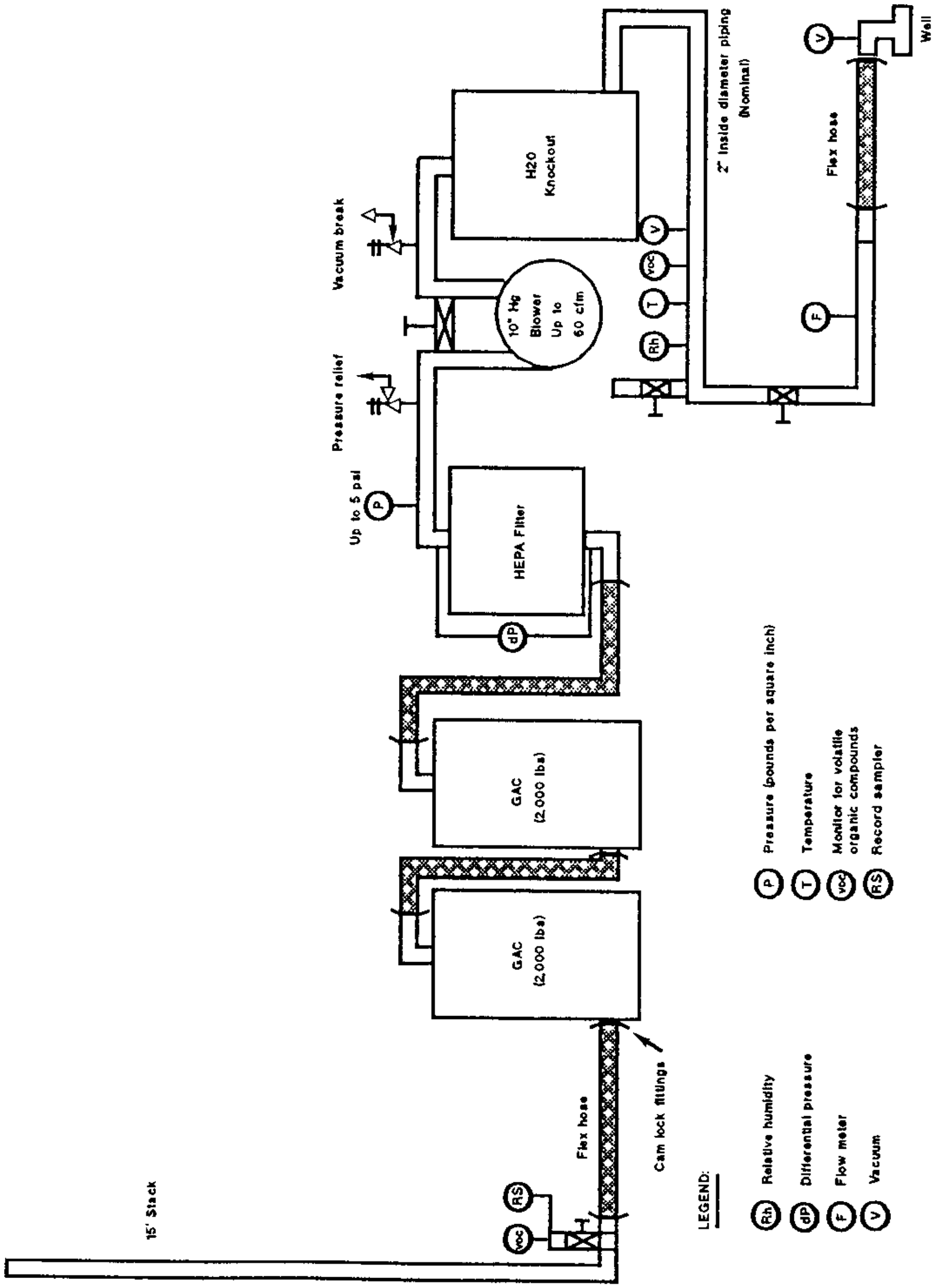
The sampling unit consists of an inlet piping manifold instrumented for flow, vacuum, and temperature and equipped with a sampling port through which gas samples may be drawn for analytical characterization. One end of the piping manifold connects to the wellhead and the other end connects to a knock out drum that connects to the low pressure side of a blower. The high pressure side of the blower connects to a high efficiency particulate air (HEPA) filter and then to a 2,000 lb granular activated carbon (GAC) filter. The exit side of the carbon filter has a second sampling port, and gases exhausted from the carbon filter are passed to the atmosphere via a 5 m (15 ft) high stack. It should be noted that the exit side of the knock out drum is equipped with a vacuum breaker, while the exit side of the blower is equipped with a pop-off valve that is set to maintain pressure in the system at < 5 lb/in^2. The capacity of the blower is 60 cfm which is equivalent to 28.3 liters/second.

3.0 CHARACTERIZATION UNIT OPERATION

Operation of the sampling unit can expected to essentially be free from any hazards relative to possible releases of hazardous materials. The system will be initially connected to well heads while the blower is not operating, and the connection secured prior to the blower being operated. Because the sampling manifold with its instrumentation and the knock out drum will be on the low pressure side of the blower, any leaks caused by weak joints, bad gaskets, or valve packing will be leaks into the system rather than the reverse. Thus, it is physically impossible for a release to take place on the low pressure side of the blower. The high pressure side of the blower is equipped with a pressure relief pop off valve set at 5 lb/in^2. Because the blower is only capable of 60 ft^3/min, the blower outlet could be dead headed, and the pressure would never begin to approach the 5 lb/in^2 required to blow the pop off valve. Thus, an environmental release via pop off valve actuation is a virtual impossibility.

A release to the environment from the sampling unit can only take place if a breach in the system takes place between the high pressure side of the blower and the inlet of the GAC unit. There are very few ways in which this could take place. The piping between the blower and the HEPA, and the HEPA and the GAC unit is flexible reinforced rubber hose. Consequently, piping or joint breaks resulting from earthquakes or other physical stresses would not be expected.

Figure 1. Characterization Sampling Unit.



Electrical generators, if used to supply power, will be located at a distance greater than 15 m (50 ft) from the sampling unit; thus the potential for fire causing a toxic release is very low. It is more likely electrical power will be supplied from the power grid. In either case, the probability of having a fire that could damage the sampling unit is very low.

Consideration has also been given to a scenario in which water condensed out from the extraction gas stream freezes up in cold weather and causes low points in the piping between the carbon vessel and the HEPA filter to burst. It is extremely unlikely that enough water would collect in the piping to cause a freeze-expansion induced failure because the piping is preceded by the knock out drum and HEPA filter. Condensation water normally collects in the knock out drum. Furthermore, because the piping between major pieces of equipment is 5 cm (2 in) diameter, reinforced rubber hose that has some capability to stretch, it is considered unlikely that the expansion created by water freezing would breach the hose.

It is also considered to be very unlikely that sufficient water could collect in the HEPA filter or the GAC unit to permit breaching of these units to result from the freezing of water.

In conclusion, no mechanisms have been identified that would provide pressure boundary failure that could result in a toxic release. The only other way that a toxic release could take place would be for the GAC unit to become saturated with CCl_4. If the unit was operated after the GAC was completely loaded, the gas exiting from the stack would be at the same carbon tetrachloride (CCl_4) concentration as the gas extracted from the ground. This will not happen because the 2,000 lb GAC unit is capable of adsorbing approximately four times the actual amount of CCl_4 that will be sent to the GAC during the planned sampling activity. This statement is based on assuming 30% capacity for the 2,000 lb GAC unit. The maximum sampling duration expected per well is 1 hour, a total of 50 wells.

If a concentration of 3,000 p/m by volume is assumed in the extraction gas which is under 25 cm (10 in) of mercury vacuum [thus pressure is 51 cm (19.9 in) mercury vacuum], and temperature is 0°C, then the source term will be the product of total gas molar flow rate and CCl_4 concentration. The gas molar volume at this pressure and temperature is 33.6 liters/mole, so the total gas molar flow rate is as follows:

28.3 liters/second/33.6 liters/mole = 0.842 moles/second

Because the extraction gas is 3,000 p/m by volume or 0.003 decimal fraction, then molar flow rate of CCl_4 is as follows:

$(0.842)(0.003) = 2.53 \times 10^{-3}$ moles CCl_4/second and mass flow rate is as follows:

$(2.53 \times 10^{-3})(154) = 0.389$ grams/s = 0.0515 lb/minute.

This mass flow rate was input as a source term to the software to calculate downwind concentration to be expected at 100 m (330 ft) distance under worst case meteorological conditions. Results indicated that concentration at 100 m (330 ft) distance would be 4.7 p/m of CCl_4. This concentration is above the 2 p/m Threshold Limit Value (TLV), but is below the

50 p/m Emergency Response Planning Guidelines-2 which is the risk acceptance criteria appropriate to 100 m (330 ft) distance. The calculations indicated that concentrations would drop below the 2 p/m TLV at a distance of 164 m (540 ft) from the stack.

DON'T SAY IT --- *Write It!* DATE: January 13, 1993

TO: Ron Lehrschall N1-75 FROM: D.K. Oestreich, N1-19

Telephone: 6-2208

SUBJECT: Use of Large Granular Activated Carbon Column on the Characterization Sampling Unit

Per your request I have considered the implications of a design change on the carbon tetrachloride (CCl_4) sampling unit that calls for increasing the size of the granular activated carbon (GAC) adsorber from 200 pounds (55 gal) to 2,000 lbs.

It has been suggested that, because of the larger size of the GAC adsorber now planned for use, handling the larger unit would increase the likelihood of dropping the unit and possibly creating a rupture spilling GAC upon the ground and releasing CCl_4. The rate at which CCl_4 would be desorbed to the air depends upon the following factors:

(1) The extent the GAC is saturated with CCl_4.

(2) The temperature of the carbon and air.

(3) The air pressure the spilled GAC is subjected to compared to the air pressure under which the GAC was loaded.

(4) The air flow rate the spilled GAC is exposed compared to the flow rate during the adsorption cycle.

The maximum duration of use of the sampling unit on any one well head is 60 minutes, while a more likely duration is 10 minutes. Because a maximum of 50 wells will be sampled, the maximum duration of the GAC unit use would be 3,000 minutes. The 2,000 lb GAC canister is predicted to have a useful lifetime of 23,301 minutes before break through, assuming a 30% working capacity for the GAC.

It can be concluded that the GAC will be far less than saturated under the reduced pressure (0.66 atmospheres) prevalent during the adsorption cycle. Because the spilled GAC is exposed to air pressure of 1 atmosphere, the CCl_4 is less likely to desorb than if the pressure were still 0.66 atmospheres. Furthermore, the air flow the spilled GAC is subject to would be far smaller than the air flow present during adsorption. It would logically follow that any loss of CCl_4 from spilled GAC to the air would be extremely slow, and resulting CCl_4 concentrations to the environment would be too low to detect.

Date Received: 1-20-93 DS	INFORMATION RELEASE REQUEST	Reference: WHC-CM-3-4

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WHC-SD-EN-SAD-004, Rev. 0-B

List attachments.
Attachments A - H

Date Release Required
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Title Safety Assessment for the 200 West Area Expedited Response Action for Remediation of Carbon Tetrachloride

Unclassified Category UC-

Impact Level 2 ESQ

New or novel (patentable) subject matter? [X] No [] Yes
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R. R. Lehrschall RR Lehrschall 1-20-93

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Responsible Manager (Printed/Signature) Date
N. R. Kerr RR Lehrschall for 1-20-93

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BD-7600-062 (08/91) WEF074

Part 1